

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

Subq1

1 2 3 4 1. A method of treating a region of skin comprising the steps of applying pulsed light, heating collagen and shrinking the collagen, thereby reviving the elasticity of the collagen and of the skin.

1 2 3 4 2. The method of claim 1, further comprising the step of protecting the epidermis and outer layers of the skin by cooling the epidermis and outer layers of the skin.

Subq2

1 2 3 4 3. The method of claim 2 wherein the step of cooling includes the step of applying a transparent substance having a temperature less than an ambient temperature, to the region of skin.

1 2 3 4 4. The method of claim 3 further including the step of controlling a delay time between the application of the substance and the application of light, to control a temperature distribution within the skin.

1 2 5. The method of claim 3 wherein the substance is ice.

1 2 6. The method of claim 3 wherein the substance is a gel.

15. The method of claim 14 further including the  
step of controlling the radiation spectrum by filtering the  
light to control a temperature distribution within the skin.

16. The method of claim 15 further including the  
steps of controlling a pulse duration and applying multiple  
pulses to control a temperature distribution within the  
skin.

1                   17. The method of claim 1 wherein the step of  
2 applying pulsed light includes the step of applying light  
3 having a wavelength in the range of 600-1200nm.

1                   18. The method of claim 1 further including the  
2                   step of directing the light to the skin using a flexible  
3                   light guide.

1                   19. The method of claim 1 further including the  
2 step of directing the light to the skin using a rigid light  
3 guide.

1                   20. A method of generating a temperature  
2                   distribution inside a region of skin having a maximum  
3                   temperature at a selected depth comprising the steps of  
4                   cooling the epidermis and outer layers of the region of  
5                   skin and applying pulsed light to the region of skin.

1                   21. The method of claim 20 wherein the step of  
2                   cooling includes the step of applying a transparent  
3                   substance having a temperature less than an ambient  
4                   temperature, to the region of skin.

16

1        28. The apparatus of claim 25 wherein the pulsed  
2        light source includes a microprocessor for determining the  
3        delay time in response to a selected collagen heating depth.

1        29. The apparatus of claim 26 including means for  
2        reducing the temperature of the cooling substance, wherein  
3        the cooling means is disposed to provide a signal indicative  
4        of cooling to the timer.

1        30. The apparatus of claim 25 wherein the pulsed  
2        light further includes a pulse formation circuit and a pulse  
3        duration input, wherein the pulse duration circuit controls  
4        the duration of pulses in response to the pulse duration  
5        input.

1        31. The apparatus of claim 25 wherein the pulsed  
2        light source includes a laser.

Sub  
1        32. The apparatus of claim 31 wherein the laser  
2        is a Nd(Yag) laser.

1        33. The apparatus of claim 31 wherein the laser  
2        is a ruby laser.

1        34. The apparatus of claim 25 wherein the pulsed  
2        light source includes a noncoherent light source.

1        35. The apparatus of claim 25 further including a  
2        filter disposed adjacent to the aperture, wherein a  
3        temperature distribution within the skin is controlled in  
4        response to a radiation spectrum produced by filtering the  
5        light.

1                    7                    26. The apparatus of claim 35 wherein the filter  
2                    is of the type that does not eliminate light having a  
3                    wavelength in the range of 600-1200nm.

1                    37. The apparatus of claim 25 further including a  
2                    flexible light guide attached adjacent to the aperture.

1                    38. The apparatus of claim 25 further including a  
2                    rigid light guide attached adjacent to the aperture.

Sub 08            1                    39. A method of cutaneous resurfacing of a region  
2                    of skin comprising the steps of producing Er:YAG laser  
3                    light, and directing the light to the region of skin.

1                    40. The method of claim 39, wherein the step of  
2                    producing includes the step of pulsing the laser light.

1                    41. The method of claim 40, wherein the step of  
2                    pulsing includes the step of delaying in the range of  
3                    0.5-10msec between pulses.

1                    42. The method of claim 40, wherein the step of  
2                    pulsing includes the step of providing pulses having energy  
3                    fluences on the order of 100J/cm<sup>2</sup>.

Sub 09            1                    43. An apparatus of cutaneous resurfacing of a  
2                    region of skin comprising an Er:YAG laser light source  
3                    disposed in a housing capable of directing light to the  
4                    region of skin.

1                    44. The apparatus of claim 43, wherein the laser  
2                    light includes a pulse forming circuit.

Sub  
a10  
1  
2  
3

45. The apparatus of claim 44, wherein the pulse forming circuit includes a pulse delay circuit for producing a delay in the range of 0.5-10msec between pulses.

1  
2  
3

46. The apparatus of claim 43, wherein the light source is capable of providing pulses having energy fluences on the order of 100J/cm<sup>2</sup>.

Sub  
a11  
1  
2  
3  
4  
5  
6  
7

47. An apparatus for the cutaneous resurfacing of a region of skin, including skin resurfacing or wrinkle smoothing, which comprises: an incoherent light source such as a flashlamp; an Er:YAG laser which can be operated in multiple pulse mode; a delivery system disposed to deliver the incoherent light and laser light to the region.

Add c1

Sub  
03

1        7. The method of claim 2 wherein the step of  
2        cooling includes the step of applying a transparent  
3        substance to the region of skin and reducing the temperature  
4        of the substance.

1        8. The method of claim 7 wherein the substance  
2        is ice.

1        9. The method of claim 7 wherein the substance  
2        is a gel.

1        10. The method of claim 2 further including the  
2        steps of controlling a pulse duration and applying multiple  
3        pulses to control a temperature distribution within the  
4        skin.

1        11. The method of claim 1 wherein the step of  
2        applying pulsed light includes the step of pulsing a laser.

1        12. The method of claim 11 wherein the step of  
2        pulsing a laser includes the step of pulsing a Nd(Yag)  
3        laser.

1        13. The method of claim 11 wherein the step of  
2        pulsing a laser includes the step of pulsing a ruby laser.

1        14. The method of claim 1 wherein the step of  
2        applying pulsed light includes the step of pulsing a  
3        noncoherent light source.

Sub  
04

1           22. The method of claim 21 further including the  
2           step of controlling a delay time between the application of  
3           the substance and the application of light, to control the  
4           temperature distribution.

*Sub  
A4*       1           23. The method of claim 20 wherein the step of  
2           cooling includes the step of applying a transparent  
3           substance to the region of skin and reducing the temperature  
4           of the substance.

1           24. The method of claim 20 further including the  
2           steps of controlling a pulse duration and applying multiple  
3           pulses.

1           25. An apparatus for treating a region of skin  
2           comprising a pulsed light source capable of heating  
3           collagen and shrinking the collagen, thereby reviving  
4           the elasticity of the collagen and of the skin, a  
5           housing, in which the light source is disposed, wherein  
6           the housing includes an aperture suitable for directing  
7           the light to the region of skin.

1           26. The apparatus of claim 25 further including a  
2           timer, connected to the pulsed light source, for indicating  
3           when a delay time has passes after an application of a  
4           cooling substance to the skin region.

1           27. The apparatus of claim 25 wherein the pulsed  
2           light source includes a microprocessor for determining the  
3           delay time in response to a selected skin temperature  
4           profile.